

High-power X- and Ka-band Gallium Nitride Amplifiers with Exceptional Efficiency, Phase I

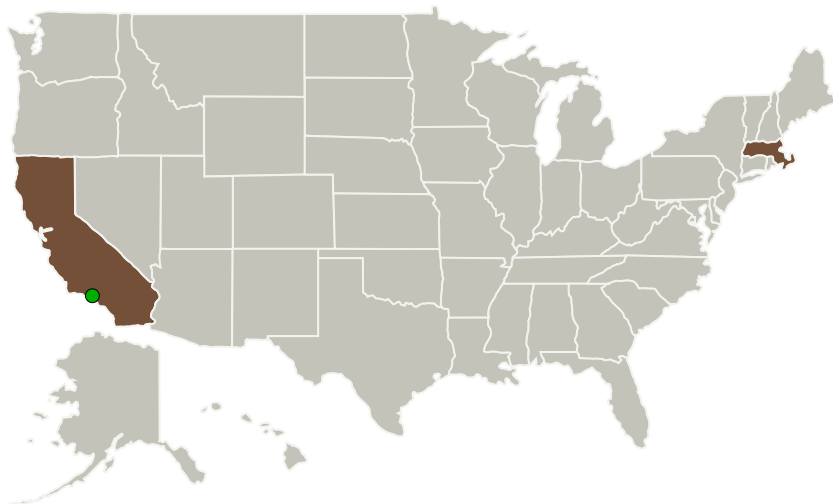
Completed Technology Project (2012 - 2012)



Project Introduction

Achieving very high-power amplification with maximum efficiency at X- and Ka-band is challenging using solid-state technology. Gallium Arsenide (GaAs) has been the material of choice for high-power microwave systems at these frequencies for decades. Until only recently, GaAs was unchallenged at Ka band for solid-state amplification. Unfortunately, the low power density of GaAs requires extensive combining networks contributing to large amplifier size and low efficiency; neither is acceptable in next-generation high-performance systems. Auriga will use a 0.15 μm Gallium Nitride (GaN) High Electron Mobility Transistors (HEMT) to meet the frequency band and power level required. GaN HEMTs are high-voltage and high power density devices, resulting in smaller, more efficient power amplifiers (PAs). Competing GaAs pHEMT technology is more mature and readily available, but cannot compete with GaN's electrical and thermal performance. As GaN transitions from leading-edge to industry standard, its usage is expanding and the cost of entry is diminishing. A precision harmonic termination circuit will be used to achieve exceptional efficiency operation. A low-loss power combining technique will generate high power levels. Auriga's experience with device physics, transistor modeling, and high-power design make us uniquely qualified to overcome the challenges in this program.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Auriga Measurement Systems (Auriga Microwave)	Lead Organization	Industry	Chelmsford, Massachusetts
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations

California	Massachusetts
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Project Transitions

▶ **February 2012:** Project Start

✓ **August 2012:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138524>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Auriga Measurement Systems (Auriga Microwave)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

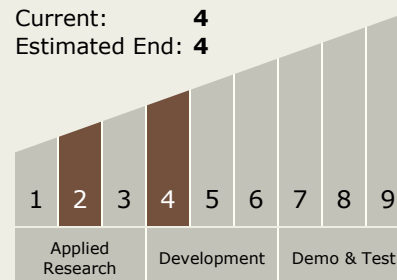
Nickolas Kingsley

Technology Maturity (TRL)

Start: 2

Current: 4

Estimated End: 4



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Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
 - └ TX05.2 Radio Frequency
 - └ TX05.2.2 Power-Efficiency

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System